GRADE 12 DIPLOMA EXAMINATION

Biology 30

June 1984

Alberta
EDUCATION

GRADE 12 DIPLOMA EXAMINATION
BIOLOGY 30

DESCRIPTION

Time: 2½ hours

Total possible marks: 100

This is a **CLOSED-BOOK** examination consisting of two parts:

PART A: 80 multiple-choice questions each with a value of 1 mark.

PART B: Eight written-response questions for a total of 20 marks.

GENERAL INSTRUCTIONS

Fill in the information on the answer sheet as directed by the examiner.

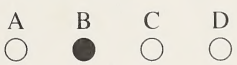
For multiple-choice questions, read each carefully and decide which of the choices BEST completes the statement or answers the question. Locate that question number on the answer sheet and fill in the space that corresponds to your choice. Use an HB pencil only.

Example

This examination is for the subject area of

A. Chemistry
B. Biology
C. Physics
D. Mathematics

Answer Sheet



If you wish to change an answer, please erase your first mark completely.

For written-response questions, read carefully and write your answer in the space provided in the examination booklet.

DO NOT FOLD EITHER THE ANSWER SHEET OR THE EXAMINATION BOOKLET.

The presiding examiner will collect the answer sheet and examination booklet for transmission to Alberta Education.

JUNE 1984

PART A

INSTRUCTIONS

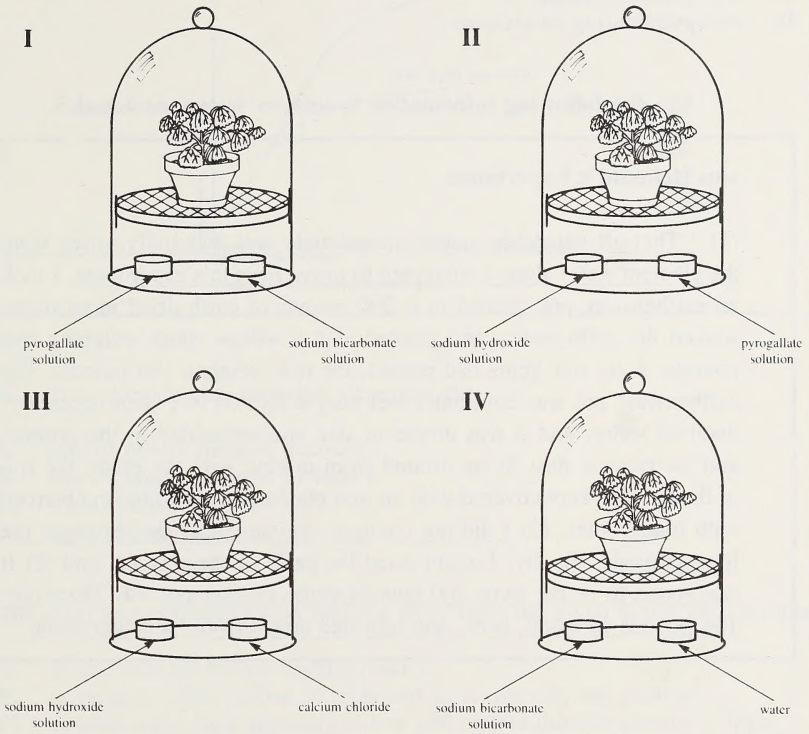
There are 80 multiple-choice questions with a value of one mark each in this section of the examination. Use the separate answer sheet provided and follow the specific instructions given.

WHEN YOU HAVE COMPLETED PART A, PROCEED DIRECTLY TO PART B.

DO NOT TURN THE PAGE TO START THE EXAMINATION UNTIL TOLD TO DO SO BY THE PRESIDING EXAMINER.

Use the following information to answer questions 1 and 2.

Assume that the green plants in each situation are identical and that each container is at the same temperature and receives 10 hours of sunlight per day.



Note: Sodium bicarbonate will release CO_2
Sodium hydroxide will absorb CO_2
Pyrogallate solution will absorb O_2
Calcium chloride will absorb water

1. Which of the situations would allow the plant to live for the longest period of time?

   A. I
   B. II
   C. III
   D. IV

2. In which situation would the greatest amount of transpiration take place?

   A. I
   B. II
   C. III
   D. IV

3. Plants have developed ways to convert phosphoglyceraldehyde (PGAL) into larger sugar units. This process may be accomplished by

A. enzymatic hydrolysis
B. dehydration synthesis
C. polypeptide linkage
D. energy-releasing catabolism

Use the following information to answer questions 4 and 5.

van Helmont's Experiment

(1) "That all vegetable matter immediately and materially arises from the element water alone I attempted to prove from this experiment. I took an earthenware pot, placed in it 200 pounds of earth dried in an oven, soaked this with water, and planted in it a willow shoot weighing five pounds. After five years had passed, the tree weighed 169 pounds. The earthenware pot was constantly wet only with rain or (when necessary) distilled water; and it was ample in size and embedded in the ground; and, to prevent dust flying around from mixing with the earth, the rim of the pot was kept covered with an iron plate coated with tin and pierced with many holes. **(2)** I did not compute the weight of the leaves of the four autumns. Finally, I again dried the earth of the clay pot and **(3)** It was found to be the same 200 pounds minus two ounces. **(4)** Therefore, 164 pounds of wood, bark, and root had arisen from the water alone."

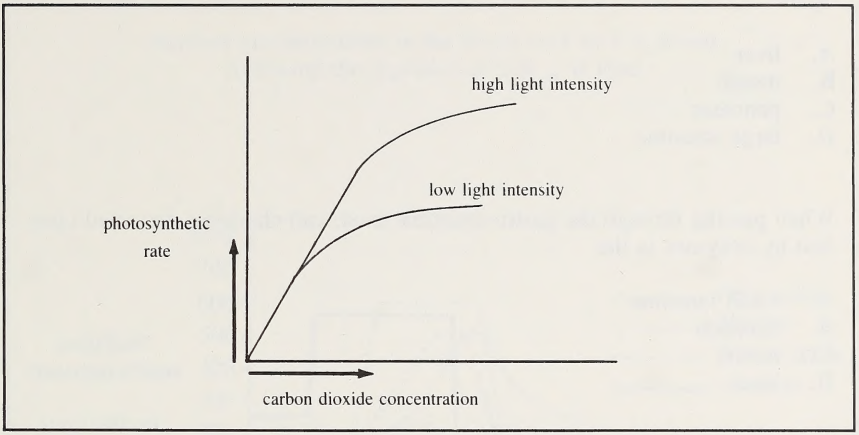
4. Which of the underlined statements presents van Helmont's hypothesis?

A. 1
B. 2
C. 3
D. 4

5. Which of Van Helmont's statements provides indirect evidence for photosynthesis?

A. 1
B. 2
C. 3
D. 4

Use the following information to answer questions 6 and 7.



6. As carbon dioxide concentration increases, the

A. rate of photosynthesis decreases
B. rate of photosynthesis increases
C. light intensity increases
D. light intensity decreases

7. The most accurate conclusion one can draw from the graph is that photosynthesis

A. is not affected by low light intensity
B. is greatest when carbon dioxide and light intensity are greatest
C. is least when light intensity is low and carbon dioxide content is high
D. is greatest when light intensity is low and carbon dioxide content is low

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8. Organisms that use energy derived from chemical reactions of inorganic substances to synthesize their protoplasm are

A. chemosynthetic autotrophs
B. photosynthetic autotrophs
C. all autotrophs
D. heterotrophs

9. Enzymes that act on fats, proteins, and carbohydrates are found in fluid secreted by the

   A. liver
   B. mouth
   C. pancreas
   D. large intestine

10. When passing through the gastro-intestinal tract, carbohydrates are acted upon first by enzymes in the

   A. small intestine
   B. stomach
   C. mouth
   D. liver

11. The removal of large portions of the stomach of a human would most directly affect the chemical digestion of

   A. fats
   B. sugars
   C. starches
   D. proteins

12. Fats are physically broken down (emulsified) in the

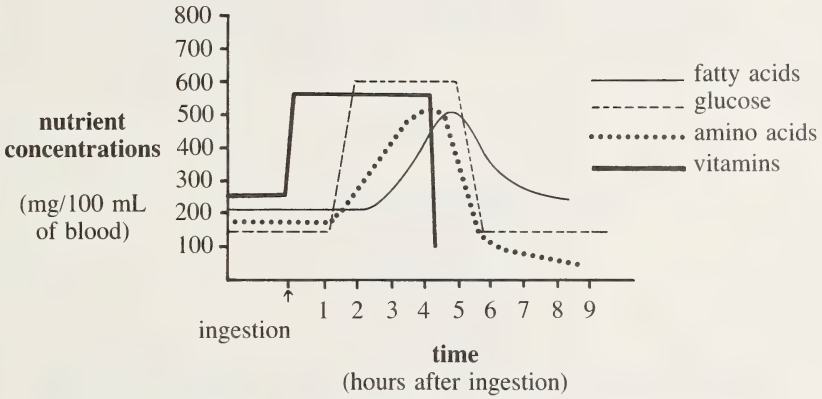
   A. entire gastro-intestinal tract
   B. stomach
   C. mouth
   D. intestine

13. Lacteals (lymph vessels) of the intestinal villi receive

   A. fat droplets
   B. glycerol and glycogen
   C. amino acids and maltose
   D. glucose and glycerin

Use the following information to answer questions 14 and 15.

Nutrient concentrations in the blood over an 8 h period following the ingestion of 300 g of food



14. The materials most easily absorbed by the digestive tract are

A. glucose and vitamins
B. fatty acids and vitamins
C. amino acids and glucose
D. amino acids and fatty acids

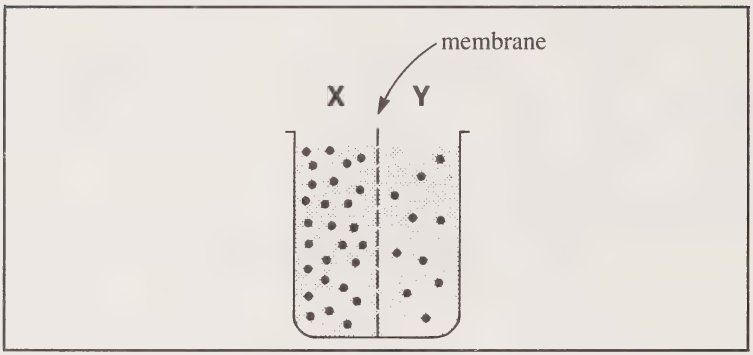
15. How long after ingestion does the concentration of carbohydrates in the blood begin to decrease?

A. Two hours
B. Four hours
C. Five hours
D. Eight hours

16. Organic compounds include all

A. salts
B. acids
C. minerals
D. carbohydrates

Use the following information to answer question 17.

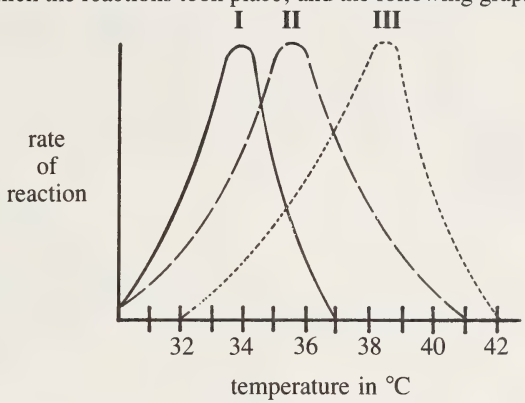


17. In the diagram, the membrane is impermeable to the particles shown and permeable to water. The net movement of water will occur

A. in both directions
B. from side X to Y
C. from side Y to X
D. in neither direction

Use the following information to answer question 18.

Three different enzymes, designated **I, II,** and **III,** catalyze three different reactions. The rates of the reactions were plotted against the temperature at which the reactions took place, and the following graph was produced.



18. If an organism depended on enzymes I, II, and III for one of its vital life activities, the best body temperature for that organism would be closest to

A. 32°C
B. 34°C
C. 37°C
D. 38°C

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19. Disaccharides are broken down into their component monosaccharides by

A. fermentation
B. phosphorylation
C. hydrolysis (hydration)
D. dehydrolysis (dehydration)

20. All buffer systems are designed to maintain

A. basic pH
B. acidic pH
C. neutral pH
D. constant pH

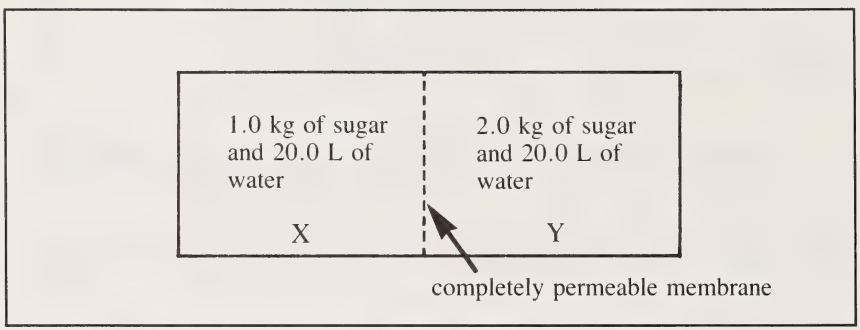
21. The drinking of sea water by humans will cause

A. swelling of body tissues
B. retention of water in the body
C. body protoplasm to dehydrate
D. decreased salt concentration in the capillaries

22. Which test could be used to show the presence of peptide bonds in a molecule?

A. Iodine solution
B. Biuret's reagent
C. Translucence test
D. Benedict's or Fehling's solution

Use the following information to answer question 23.



23. The end result on side X will be

A. 2.0 kg of sugar and 20.0 L of water
B. 1.5 kg of sugar and 20.0 L of water
C. 1.0 kg of sugar and 10.0 L of water
D. 1.5 kg of sugar and 30.0 L of water

24. The beet root contains higher concentrations of sodium ions than the surrounding soil. This is best explained by

A. osmosis
B. diffusion
C. active transport
D. pinocytosis (endocytosis)

25. In a human's white blood cells, foreign particles are engulfed by a process called

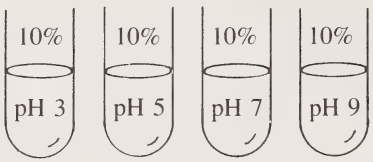
A. exocytosis
B. active transport
C. Brownian movement
D. phagocytosis (endocytosis)

Use the following information to answer question 26.

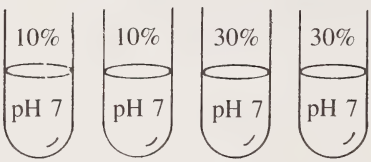
Each test tube contains 1 mL of saliva and 5 mL of starch solution at the concentrations indicated.

Concentration of starch solution is indicated in percentages.

I

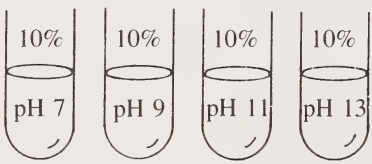


II

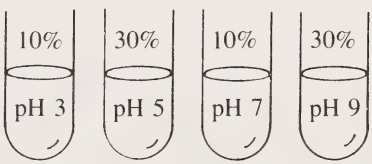


boiled saliva

III



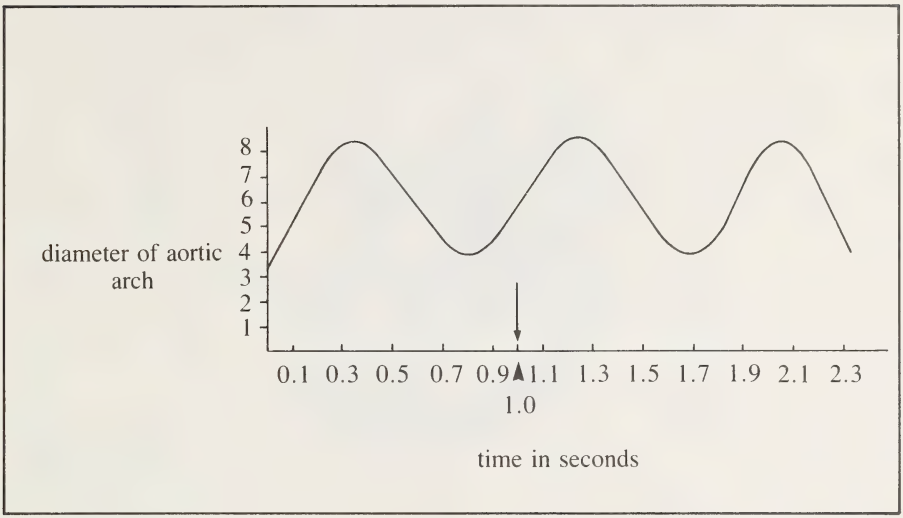
IV



26. Which of the experimental designs would be most appropriate to test the effect of pH on the activity of amylase found in saliva?

A. I
B. II
C. III
D. IV

Use the following information to answer question 27.



27. At time 1.0 s (arrow on the graph), the A-V valves (between the atrium and the ventricle) would be

A. closed, and the exit valves would be opened
B. opened, and the exit valves would be closed
C. closed, and the exit valves would be closed also
D. opened, and the exit valves would be opened also

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28. A lab technician is given two unmarked bottles of blood-typing serum, one anti-A serum and the other anti-B serum. Of a variety of typed human blood available, which would be most valuable to the technician in identifying the contents of the bottles?

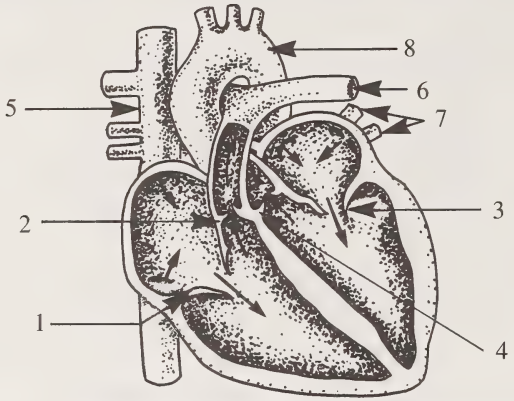
A. O
B. A and B
C. B and O
D. O and AB

29. When a lymph vessel becomes blocked, the surrounding tissues become

A. swollen because of the drop in blood pressure
B. dehydrated because of the drop in blood pressure
C. dehydrated because of the accumulation of proteins in the surrounding interstitial fluid (ECF)
D. swollen (edema) because of the accumulation of proteins in the surrounding interstitial fluid (ECF)

Use the following information to answer questions 30 to 32.

Ventral View of a Mammalian Heart (Diagrammatic)



30. Blood in the structure labelled 8 is

A. oxygenated
B. going to the lungs
C. returning from the liver
D. high in carbonate ion content

31. The first heart sound is produced by the closing of the valves labelled

A. 1 and 2
B. 1 and 3
C. 2 and 4
D. 3 and 4

32. What structures direct blood back to the heart?

A. 5 and 7
B. 7 and 8
C. 8 and 6
D. 3 and 5

33. Tissue swelling, or edema, occurs when there is

A. an increase in blood pressure and hypertonic (more concentrated) capillary fluid

B. an increase in blood pressure and hypotonic (less concentrated) capillary fluid

C. a decrease in blood pressure and hypotonic (less concentrated) capillary fluid

D. a decrease in blood pressure and hypertonic (more concentrated) capillary fluid

Use the following information to answer question 34.

	Mass (kg)	Systolic Blood Pressure (mm Hg)	Diastolic Blood Pressure (mm Hg)	Pulse Rate
Subject X	70	120	80	70
Subject Y	70	130	80	60
Subject Z	70	100	80	100

NOTE: Blood pressure and pulse rate were taken when all three subjects were at rest.

34. Based on the table, which conclusion is valid?

A. Subject X is healthy, while subject Y is suffering from hardening of the arteries and subject Z has a kidney disorder.

B. Subject Y is much larger than either subject X or subject Z, and therefore requires more oxygen.

C. Subject Y's heart pumps with greater force and therefore does not have to pump as often.

D. Subject Z has a very strong heart, capable of beating rapidly.

Use the following information to answer question 35.

Capillaries were observed microscopically. Each of 10 capillaries was subjected to a series of treatments as outlined below. Each capillary was allowed to recover from the effects of one treatment before being subjected to the next.

Treatment	Average Flow of Blood Cells/Minute
1. none (normal)	600
2. adrenalin added	400
3. alcohol added	800
4. lactic acid added	900
5. temperature reduced	300

35. The arterioles leading to the capillaries dilated in treatment(s)

A. 3 and 4 only
B. 4 and 5 only
C. 2 only
D. 5 only

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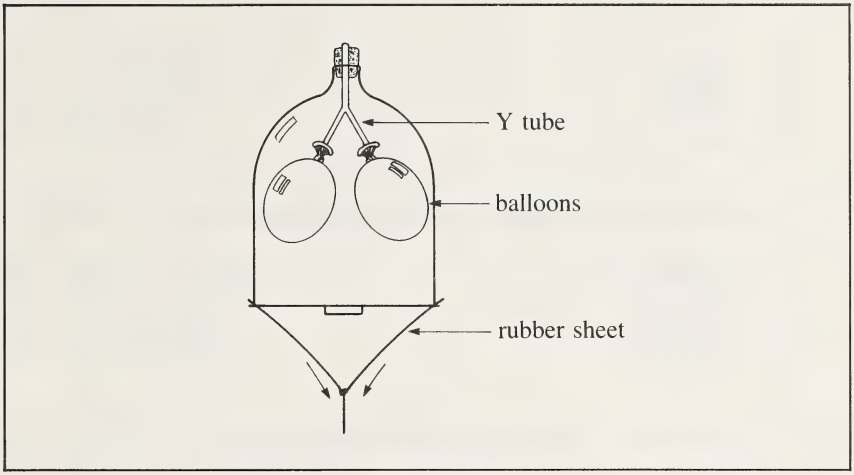
36. A blood pressure reading of 80/50 mm of mercury would be a symptom of

A. anger
B. hemorrhage
C. narrowing of the arteries
D. extremely strenuous exercise

Use the following information to answer question 37.



37. The rubber sheet shows the operation of the

A. rib-cage
B. diaphragm
C. alveolar sacs
D. pleural membrane

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38. The actions that cause exhalation (expiration) are

A. relaxation of the diaphragm and lifting of the rib-cage
B. contraction of the diaphragm and lifting of the rib-cage
C. relaxation of the diaphragm and dropping of the rib-cage
D. contraction of the diaphragm and dropping of the rib-cage

39. Diffusion of carbon dioxide from the cells of the body to the capillaries and of oxygen to the cells of the body is due to

A. high cellular carbon dioxide and high capillary oxygen levels
B. high capillary carbon dioxide and low cellular oxygen levels
C. low capillary carbon dioxide and high cellular oxygen levels
D. low cellular oxygen and low capillary oxygen levels

40. Gaseous and nutritional exchanges between the circulatory system and the body tissues occur in

A. venules
B. capillaries
C. arterioles
D. arteries

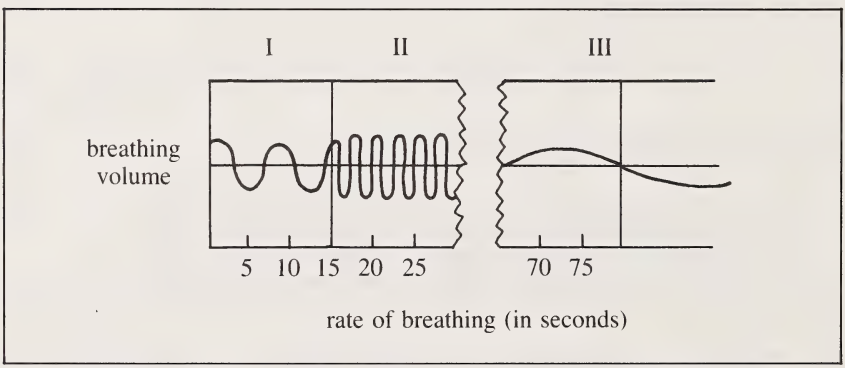
41. Carbon dioxide concentration would be highest in the

A. pulmonary vein
B. vena cava
C. left atrium
D. renal artery

42. After black-out or fainting, breathing will begin again

A. if there is a fresh supply of oxygen for the mitochondria
B. when the chest muscles expand and the diaphragm relaxes
C. when oxygen concentration is decreased by cell respiration
D. when carbon dioxide concentration is increased by cell respiration

Use the following information to answer question 43.



43. Which section(s) of the graph indicate(s) the process of replacing the oxygen debt immediately after a person runs 100 m?

A. I
B. II
C. I and II
D. I and III

44. Before glucose can be utilized in cellular respiration, the glucose molecule must undergo

A. phosphorylation
B. dehydrogenation
C. decarboxylation
D. fermentation

45. In addition to glucose, energy sources that cells may use are

A. minerals and salts
B. fats and minerals
C. proteins and fats
D. salts and proteins

46. An oxygen debt in muscle tissue results in the

A. breakdown of lactic acid
B. breakdown of pyruvic acid
C. accumulation of lactic acid
D. accumulation of pyruvic acid

47. The difference between anaerobic respiration in plants and anaerobic respiration in animals is that

A. there is a difference in end-products
B. plants require sunlight for respiration, but animals do not
C. only one of them requires a carbohydrate as a starting substance
D. plants do not require oxygen, but animals need a minimal amount

48. Which of the following might illustrate the conversion that supplies the required energy for muscle contraction?

A. Adenosine triphosphate (ATP) $\longrightarrow$ adenosine diphosphate (ADP) + phosphorus (P)
B. Adenosine diphosphate (ADP) $\longrightarrow$ adenosine triphosphate (ATP)
C. Glucose $\longrightarrow$ CO_2 + lactic acid
D. O_2 $\longrightarrow$ lactic acid + CO_2

49. Mitochondria would be most numerous in

A. skin cells
B. lung cells
C. blood cells
D. muscle cells

50. In which case does active transport occur?

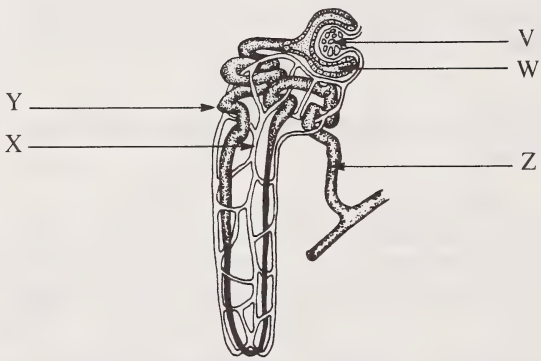
A. Water excretion from the bladder
B. Sodium reabsorption in the kidney
C. Transfer of glucose from blood to the nephric capsule
D. Transfer of amino acids from blood to the nephric capsule

51. Which of the following cell activities would require the SMALLEST expenditure of cell energy?

A. Muscle contraction
B. Biochemical synthesis
C. Nerve action potential
D. Alveolar gas exchange

Use the following information to answer questions 52 and 53.

A Nephron



52. Filtration occurs at the area labelled

A. V
B. X
C. Y
D. Z

53. The antidiuretic hormone (vasopressin) acts on the area labelled

A. W
B. X
C. Y
D. Z

54. If the urine of a healthy person were analyzed, there would be only trace amounts of

A. urea
B. water
C. glucose
D. mineral salts

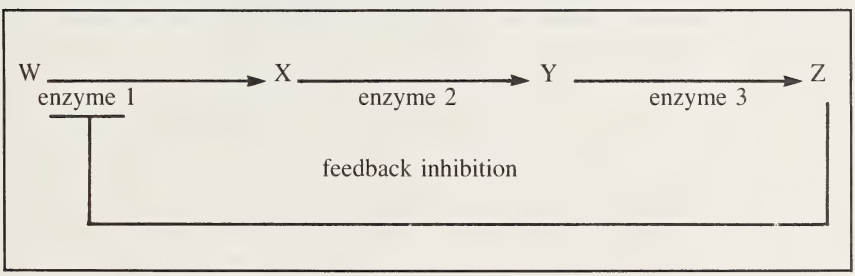
55. Plasma moves into the Bowman's capsule because of

A. osmosis
B. diffusion
C. force filtration
D. active transport

56. The inability of a pituitary gland to release an antidiuretic hormone (vasopressin) would inhibit the reabsorption of

A. water
B. glucose
C. amino acids
D. sodium ions

Use the following information to answer question 57.



57. As the concentration of Z decreases in the cell, enzyme 1 will convert

A. more W to X
B. less W to X
C. more X to W
D. less X to W

58. A plant stem placed horizontally will grow upwards because of

A. a greater amount of auxins on the upper surface
B. a greater amount of auxins on the lower surface
C. an increased production of auxins in the apex
D. a decreased production of auxins in the apex

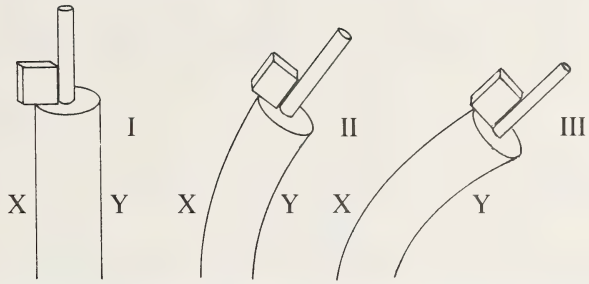
Use the following information to answer question 59.

> White light can be separated into a spectrum of colors ranging from violet, which is produced by short wavelengths, to red, which is produced by long wavelengths. Chlorophyll is green, from which we may infer that only the ends of the spectrum are used in photosynthesis.

59. If the process had evolved differently, so that only light waves of medium length were used in photosynthesis, what colors would the leaves of our trees and plants probably be?

A. Blue and orange
B. Green and red
C. Blue and green
D. Violet and red

Use the following information to answer question 60.

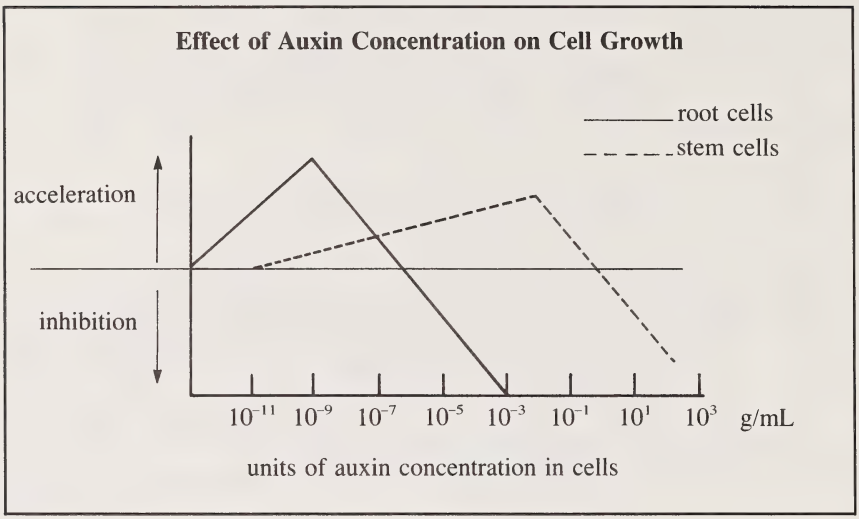


A student prepared three agar blocks containing different concentrations of an auxin (indole - 3 - acetic acid). (I served as control, II contained a low concentration, and III contained a higher concentration of the compound.) These blocks were then placed on the decapitated stumps of the coleoptiles of oat plants I, II, and III as shown in this diagram, and the curvature of each oat plant was noted.

60. Which of the following statements explains the curvature of the coleoptile in plant III?

A. Light source at right; greater concentration of auxin at Y than at X
B. Light source at right; greater concentration of auxin at X than at Y
C. Light source at left; greater concentration of auxin at Y than at X
D. Light source at left; greater concentration of auxin at X than at Y

Use the following information to answer question 61.



61. Which auxin concentration would inhibit root growth and accelerate stem growth?

A. 1.0×10^{-11} g/mL
B. 1.0×10^{-5} g/mL
C. 1.0×10^{-1} g/mL
D. 1.0×10^{3} g/mL

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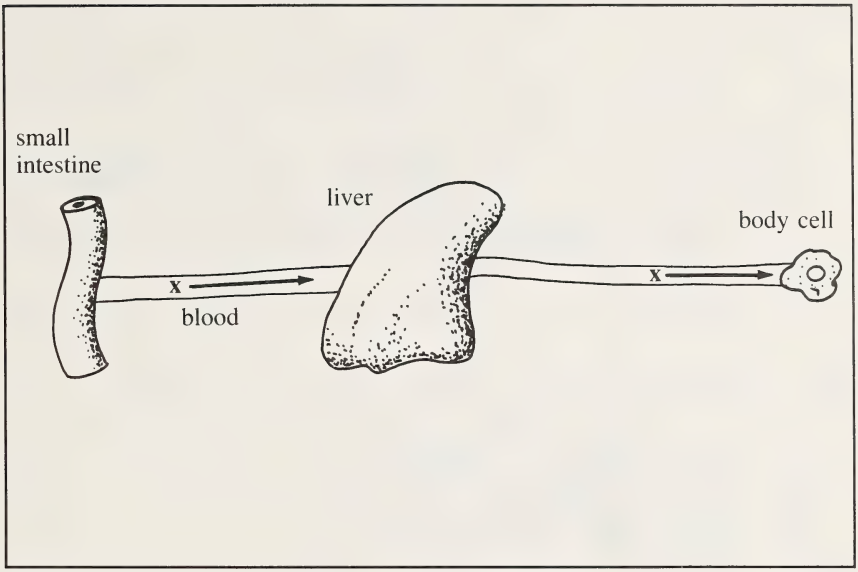
62. If a person drinks a large amount of water, his blood becomes diluted. The body immediately reacts by

A. increasing salt retention in the kidney
B. decreasing salt retention in the kidney
C. secreting vasopressin (antidiuretic hormone)
D. inhibiting the secretion of vasopressin (antidiuretic hormone)

63. Prolonged exposure of animals to cold may produce as much as a 20% increase in the size and activity of the

A. thyroid
B. spleen
C. kidneys
D. pituitary

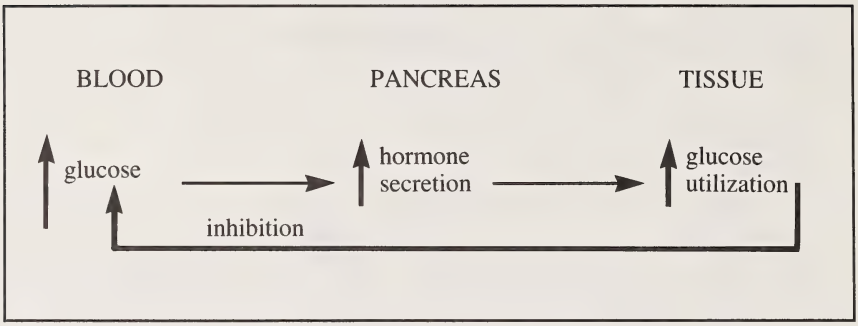
Use the following information to answer question 64.



64. Substance X is picked up by the blood in the small intestine. Excess X is carried to the liver, where it is converted to glycogen. The hormone that controls this process of removing X from the blood is

A. gastrin
B. insulin
C. adrenalin (epinephrine)
D. vasopressin (antidiuretic hormone)

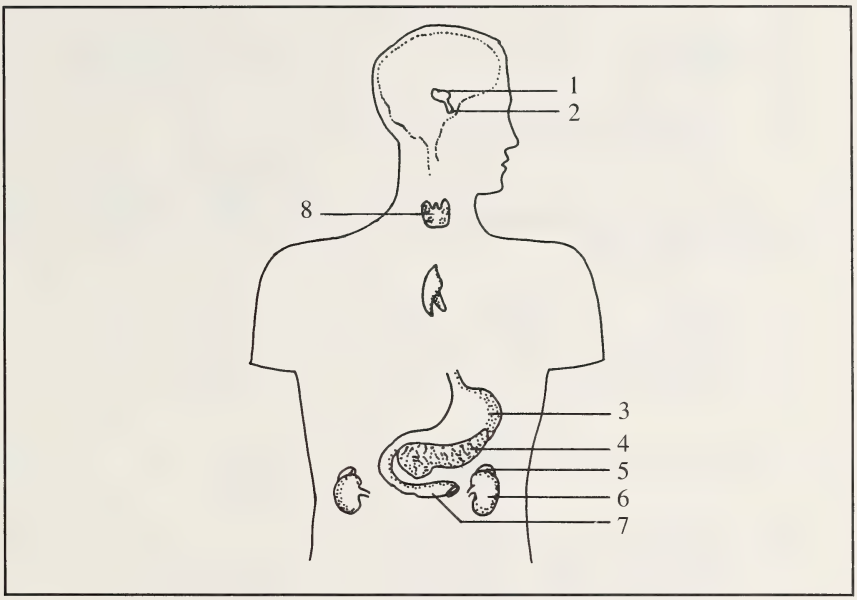
Use the following information to answer question 65.



65. The physiological response at the tissue level could be classified as

A. diabetes mellitus
B. decreased respiration
C. homeostatic adjustment
D. positive feedback (precursor activity)

Use the following information to answer question 66.



66. A person who tires easily and uses less oxygen than normal has an underactive

A. 3
B. 4
C. 6
D. 8

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67. A lack of energy, no appetite, constant thirst, and high urine output could be associated with an abnormal decrease in the body's production of

A. insulin
B. adrenalin
C. growth hormone
D. vasopressin (antidiuretic hormone)

68. A man balancing himself on a tightrope does NOT depend on sensory input from the

A. cochlea
B. cerebellum
C. semicircular canals
D. proprioceptors (pressure receptors)

69. A person's heart and respiration rate varies unexpectedly. One might suspect damage to the brain's

A. medulla
B. cerebrum
C. cerebellum
D. olfactory lobes

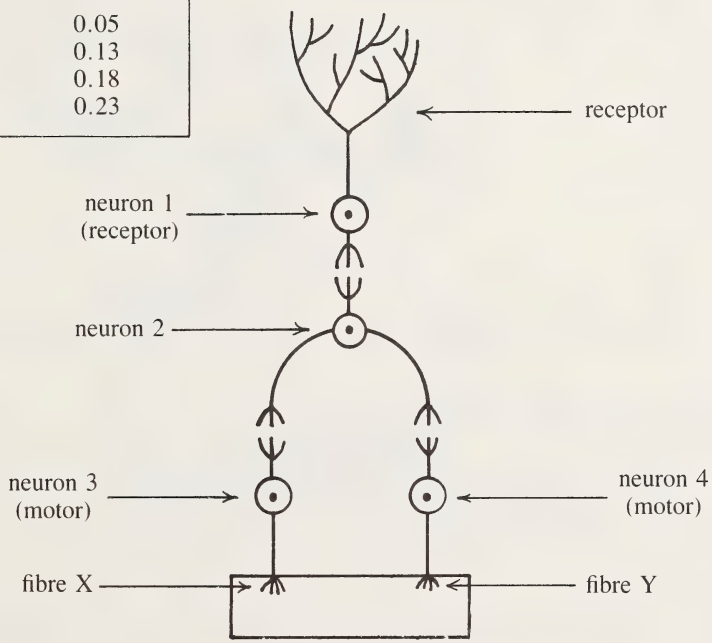
70. A reflex action involves a sensory nerve,

A. the spinal cord, and a motor nerve
B. the spinal cord, and the medulla
C. the cerebrum, and a motor nerve
D. the spinal cord, and the cerebellum

Use the following information to answer questions 71 and 72.

The diagram shows a system of neurons, each of which has a different threshold of stimulation.

Neuron Number	Threshold Stimulus (V)
1	0.05
2	0.13
3	0.18
4	0.23



71. If the receptor neuron was stimulated with 0.15 V, the impulse would

A. NOT pass to neuron 2
B. pass to neuron 2 and then to neuron 3
C. pass to neuron 2 and NOT to neurons 3 and 4
D. NOT be sufficient to initiate an impulse in the receptor neuron

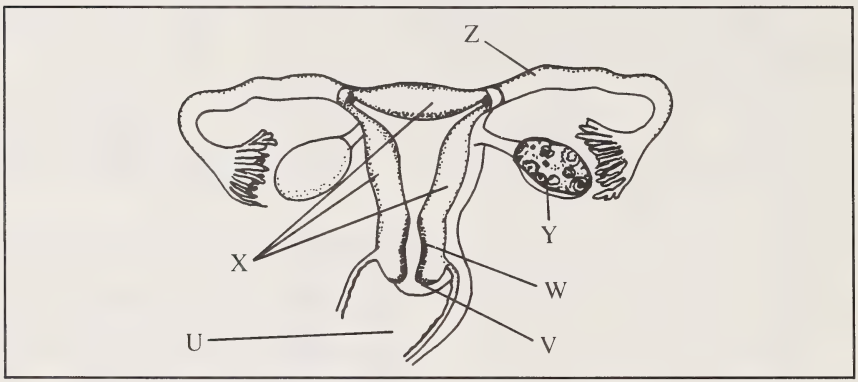
72. A stimulus of 0.20 V initiates nerve action and is

A. strong enough to stimulate fibre X but not fibre Y
B. strong enough to stimulate fibre Y but not fibre X
C. strong enough to stimulate both fibre X and fibre Y
D. not strong enough to stimulate either fibre X or fibre Y

73. If the vagus (parasympathetic) nerve to a heart is stimulated, then the heart will

A. speed up
B. slow down
C. remain beating at the same speed
D. speed up initially then slow down

Use the following information to answer questions 74 to 76.



74. The structure labelled X is necessary for

A. ovulation
B. fertilization
C. implantation of the ova
D. development of secondary female sex characteristics

75. Which of the following is NOT a function of the structure labelled Y?

A. Ovulation
B. Production of estrogen
C. Production of androgen
D. Formation of corpus luteum

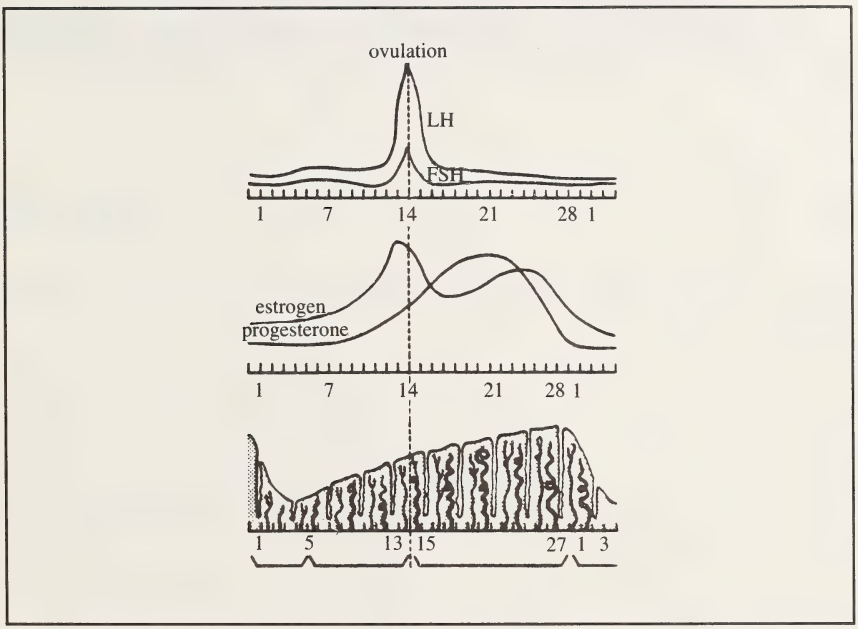
76. The egg is normally fertilized in the structure labelled

A. U
B. V
C. X
D. Z

77. An adult male Caucasian who lacks facial hair, has a high-pitched voice, and has a well-developed layer of body fat, likely suffers from insufficient secretion of

A. testosterone
B. progesterone
C. human growth hormone (HGH)
D. follicle-stimulating hormone (FSH)

Use the following information to answer questions 78 and 79.



78. From the information provided by the diagram, we might conclude that

A. ovulation inhibits the production of progesterone
B. high levels of progesterone inhibit the luteinizing hormone (LH)
C. follicle stimulating hormone (FSH) production is increased by the corpus luteum
D. menstruation occurs when the levels of estrogen and progesterone reach their peak

79. One would expect to find a functional corpus luteum on the

A. 1st day
B. 5th day
C. 10th day
D. 20th day

80. A malfunction of the placenta might cause premature birth because of

A. a lack of proper ovulation
B. excess progesterone secretion
C. the endometrium beginning to increase in thickness
D. the lack of progesterone to prevent muscular contraction

YOU HAVE NOW COMPLETED THE MULTIPLE-CHOICE SECTION OF THE EXAMINATION. PLEASE PROCEED TO THE NEXT PAGE AND ANSWER THE WRITTEN-RESPONSE QUESTIONS IN PART B.

PART B

INSTRUCTIONS

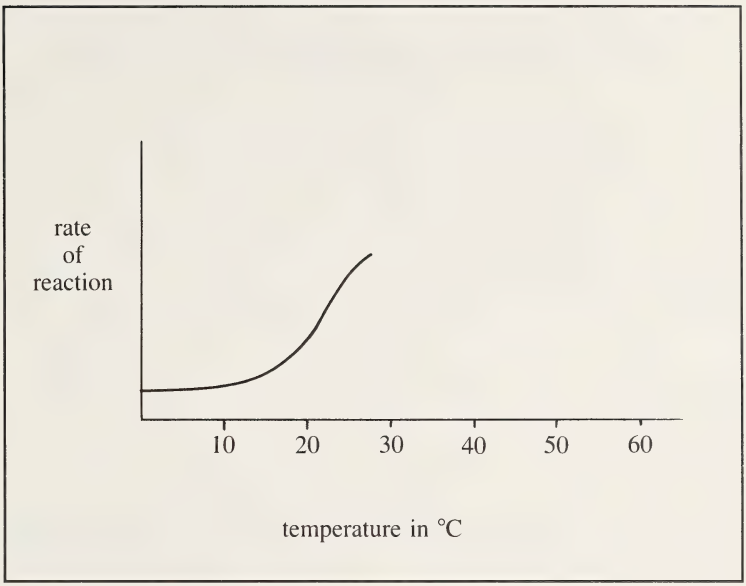
Please write your answers in the examination booklet as neatly as possible.

TOTAL MARKS: 20

START PART B IMMEDIATELY

(USE FOR ROUGH WORK ONLY)

Use the following information to answer question 1.



1. The above graph represents normal human enzymatic activity. Complete the graph and explain what will happen at 45°C and for what reason.

(3 marks)

(USE FOR ROUGH WORK ONLY)

Use the following information to answer question 2.

Internal Pressure of Leaf Cells as Recorded on a Sunny Summer Day		
	Pressure (kPa)	
Time	Guard Cells	Epidermal Cells
07:00	10	10
12:00	111	10
19:00	40	10

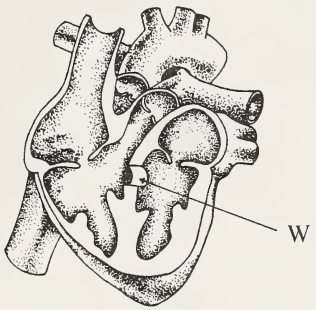
2. When is the pressure in the guard cells the greatest, and how do the stomata respond to it?

(2 marks)

(USE FOR ROUGH WORK ONLY)

Use the following information to answer question 3.

Ventral View of a Mammalian Heart (Diagrammatic)



3. Explain why an opening in the septum at W would be a serious disadvantage to anyone wanting to become an athlete.

(2 marks)

4. If an individual has an abnormally low secretion of gastrin, in what three ways would this affect the digestion of a meal that included steak and eggs fried in butter?

(3 marks)

(USE FOR ROUGH WORK ONLY)

5. A particular drug causes the afferent (incoming) renal arterioles to dilate, while constricting the efferent (outgoing) renal arterioles. Why would this drug act as a diuretic? (NOTE: A diuretic increases urine output.)

(2 marks)

6. Discuss ONE way in which a secretion of the thyroid gland assists in maintaining blood sugar level.

(2 marks)

(USE FOR ROUGH WORK ONLY)

7. A person is suffering from hypoglycemia (low blood sugar). Which hormone, insulin, adrenalin, or thyroxin, might help that person? Explain your answer.

(2 marks)

8. **a.** Sodium ions are pumped out of the neuron while potassium ions are pumped into the neuron by the sodium/potassium pump. If one positive ion is exchanged for another, how would you account for the polarity of the resting membrane?

(2 marks)

8. **b.** Explain why the polarity is reversed during an action potential (nerve impulse).

(2 marks)

YOU HAVE NOW COMPLETED THE EXAMINATION. IF YOU HAVE TIME, YOU MAY WISH TO GO BACK AND CHECK YOUR ANSWERS.

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M1 M2 M3

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(LAST NAME) (FIRST NAME)

NAME:

Y M D

DATE OF BIRTH: SEX:

SCHOOL CODE: SCHOOL: _____

CITY: _____

NAME OF EXAMINATION: _____

SIGNATURE: _____

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